IOWA DEPARTMENT OF TRANSPORTATION

To Office Bridges and Structures Date July 24, 2003

Attention All Employees Ref No. 521.3

From Gary Novey

Office Bridges and Structures

Subject MM No. 70 (Anchorage of Steel Reinforced Elastomeric Bearings)

Because Iowa precast beam manufacturers have begun adding galvanized steel plates at the ends of prestressed beams, beams simply placed on steel reinforced elastomeric bearings will have galvanized steel rather than concrete contact surfaces. Consequently the office has reexamined anchorage of elastomeric bearings.

The AASHTO Standard Specifications for Highway Bridges indirectly permit elastomeric bearings to be anchored by friction assuming an allowable coefficient of friction of 0.2 [AASHTO 14.6.6.4], without specifying the materials of the bearing contact surfaces.

U.S. testing since the late 1950s has indicated coefficients of friction above 0.2 for steel reinforced elastomeric bearings on concrete or steel surfaces. Coefficients of friction are lower for smoother concrete or steel surfaces and for higher compressive stresses. Usually elastomer against a steel surface has a lower coefficient of friction than elastomer against a concrete surface. Recent U.S. testing has indicated that the coefficient of friction for a smooth concrete surface will approach 0.2 at typical dead load compressive stress [Muscarella and Yura 1995].

No recent U.S. test results are available for steel reinforced elastomeric bearings on galvanized steel surfaces. However, for slip critical bolted steel connections, roughened galvanized steel faying surfaces generally have slip coefficients in the same general range as those for steel surfaces. The Specification for Structural Joints Using ASTM A325 or A490 Bolts [RCSC 1985] requires that roughening of galvanized steel faying surfaces be achieved by hand wire brushing.

The AASHTO LRFD specifications have indirectly lowered the allowable coefficient of friction to 0.167 (determined by dividing 0.2 by a load factor of 1.2) [AASHTO LRFD 3.4.1, 14.7.6.4]. There is no obvious reason for the lower coefficient of friction.

Based on published U.S. test results and additional information, the office will use an allowable coefficient of friction of 0.2, as indicated by the AASHTO standard specifications. The coefficient of friction shall be used to check friction anchorage of steel reinforced elastomeric bearings placed between

- Ordinary rough concrete bearing seats and concrete or roughened* galvanized steel plate bearing surfaces of precast prestressed concrete beams or
- Ordinary rough concrete bearing seats and galvanized steel plate-keeper bar assemblies (below precast prestressed concrete beams or steel girders).

If a bearing fails to provide sufficient slip resistance through friction, the bearing shall be restrained to prevent walking.

Steel reinforced elastomeric bearings placed between two steel or galvanized steel bearing surfaces shall be restrained with keeper bars, vulcanization, or other means at each surface. Anchorage by friction is unacceptable at either of the two surfaces.

Plain elastomeric bearing pads typically have relatively low coefficients of friction on concrete or steel surfaces, and the above policy does not apply to plain pads.

* The bottom surface of the galvanized steel plate shall be roughened by hand wire brushing. Power wire brushing is not allowed.

References:

Muscarella, J.V. and Yura, J.A. (1995). *An Experimental Study of Elastomeric Bridge Bearings with Design Recommendations, Research Report 1304-3*. Center for Transportation Research, University of Texas at Austin, Austin.

Research Council on Structural Connections (RCSC). (1985). Specification for Structural Joints Using ASTM A325 or A490 Bolts, RCSC.

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